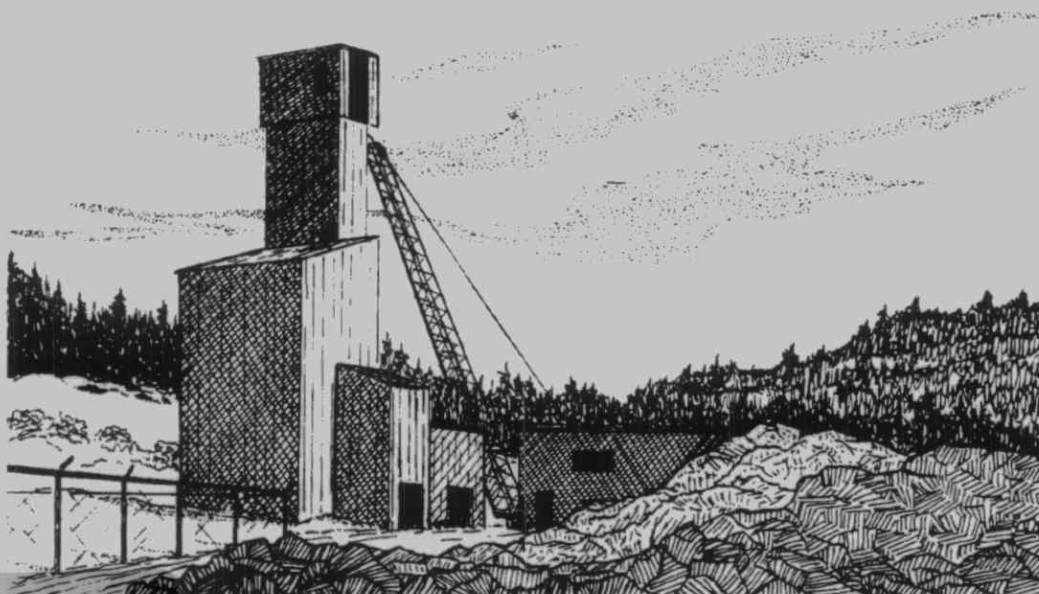


STANDARDS DEVELOPMENT BRANCH OMDE



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AIRBORNE ARSENIC  
near  
DICKENSON MINES,  
BALMERTOWN, 1989-90.



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AIRBORNE ARSENIC  
near  
DICKENSON MINES, BALMERTOWN

1989-90

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ONTARIO MINISTRY OF THE ENVIRONMENT

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## INTRODUCTION

In response to concerns about possible elevated levels of airborne arsenic, the Ontario Ministry of the Environment began a one-year survey to monitor air quality near Dickenson Mines Limited, Balmertown. The suspected source of arsenic emissions was windblown dust from gold ore concentrate on Dickenson's property. Sampling started in early October, 1989, and concluded near the end of September, 1990.

## STUDY METHODS

Two air sampling sites were selected: station 61017 on Dickenson property, and station 61016 in the nearby residential part of Balmertown. The locations of these sites are shown in the attached map.

Samples were collected on glass fibre filters for a 24-hour period every 6 days. Standard high-volume samplers were used, at an air flow rate of about  $1.7 \text{ m}^3/\text{min}$ . Exposed filters were analyzed for total suspended particulate matter, arsenic, iron and lead.

Sampling results from the residential site (station 61016) were judged in relation to Ministry of the Environment air quality objectives. At station 61017 on Dickenson's property, the data were compared to levels specified in the Occupational Health and Safety Act.

## RESULTS

### Residential Area

Table 1 presents results of the air quality survey. Valid data were obtained for 111 of a possible 120 samples (92%).

Malfunctioning equipment or sampling errors accounted for the missing values.

In the residential area (station 61016), total suspended particulate matter consistently met the Ontario air quality objective of  $120 \mu\text{g}/\text{m}^3$  (micrograms per cubic metre of air), 24-hour average. The geometric mean of  $21 \mu\text{g}/\text{m}^3$  was also well below the maximum acceptable limit of  $60 \mu\text{g}/\text{m}^3$ , annual average.

Arsenic at station 61016 also met the objective of  $0.3 \mu\text{g}/\text{m}^3$ , 24-hour average, for all but one sample. On March 18, 1990, an arsenic concentration of  $2.22 \mu\text{g}/\text{m}^3$  was recorded. The reason for this high reading is unknown. Prevailing wind on March 18 was northwest, as measured at Red Lake Airport, 4.3 kilometres west of Dickenson. This wind direction suggests that Dickenson was not the source.

Lead concentrations at the residential monitoring site were well below the acceptable limit of  $2.0 \mu\text{g}/\text{m}^3$ , 24-hour average. Although the Ministry does not currently have an objective for iron in sulphide form, iron levels at station 61016 were at the low end of the range found in urban areas.

### **Mine Property**

Sampling periods at our monitoring site on Dickenson property (station 61017) differed from those normally used in workplace settings. Despite this, there is a very high probability that worker exposure limits specified in the Occupational Health and Safety Act were not exceeded at Dickenson monitoring site. The maximum concentration of suspended particulate matter recorded at station 61017 was  $427 \mu\text{g}/\text{m}^3$ , 24-hour average. This concentration is well below the  $10,000 \mu\text{g}/\text{m}^3$  allowed for a time-weighted average exposure (i.e. a normal, 40-hour work week).

The highest 24-hour arsenic concentration measured on Dickenson's property was  $14.23 \mu\text{g}/\text{m}^3$ . At this level, the occupational exposure limit of  $10 \mu\text{g}/\text{m}^3$  for a time-weighted average exposure might have been exceeded. The maximum lead concentration recorded on mine property during the survey was  $1.18 \mu\text{g}/\text{m}^3$ , well below the time-weighted exposure limit of  $150 \mu\text{g}/\text{m}^3$ . The highest iron level was  $42 \mu\text{g}/\text{m}^3$ . While there is no occupational exposure value for iron in sulphide form, the highest level of iron found in this survey is not considered hazardous.

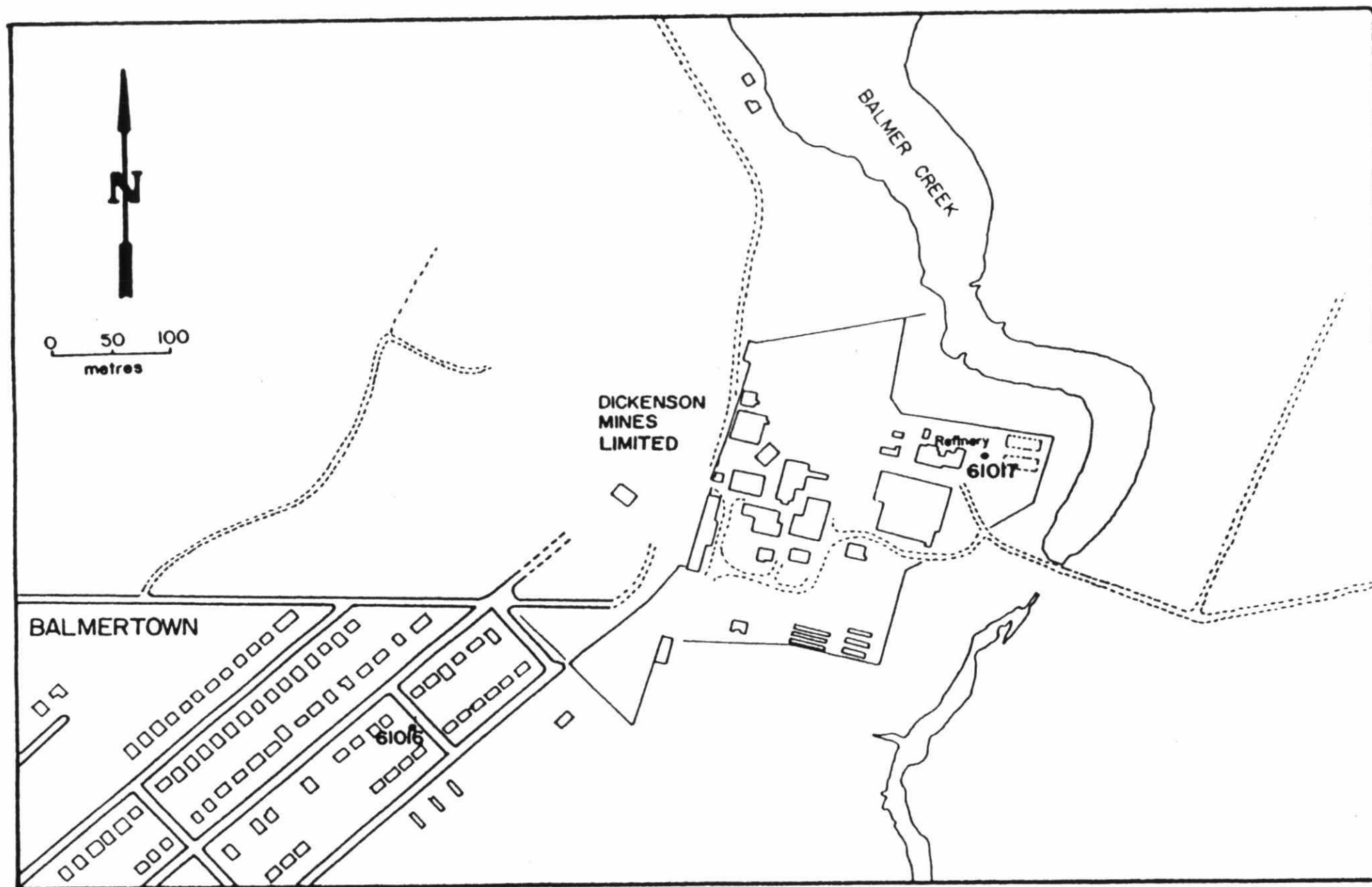
Although some of the concentrations of arsenic and suspended particulate matter on Dickenson's property exceeded Ministry of the Environment objectives, such objectives do not apply to workplace settings.

#### SUMMARY

A one-year air quality survey was carried out near Dickenson Mines Limited, Balmertown. The study showed that in 55 of 56 samples, arsenic met the Ministry air quality objective at a residential monitoring site near the mine. Concentrations of total suspended particulate matter, iron and lead at this site all met Ministry objectives. There was no evidence of measurable impact of gold ore concentrate dust emissions from Dickenson's operation on air quality in the adjacent residential area.

With the possible exception of one sample out of 51, arsenic on Dickenson's property met occupational health exposure limits. Lead concentrations were consistently low and were well below the maximum acceptable limit.

Based on our study, airborne arsenic on and near Dickenson's gold mine at Balmertown appeared to be within acceptable limits.



High-volume air sampling sites, Balmertown.

TABLE 1. Levels of suspended particulate matter, arsenic, iron and lead in air near Dickenson Mines Limited, Balmertown. All values are in  $\mu\text{g}/\text{m}^3$ .

Date	Station 61016				Station 61017			
	TSP <sup>a</sup>	As <sup>b</sup>	Fe <sup>c</sup>	Pb <sup>d</sup>	TSP	As	Fe	Pb
<u>1989</u>								
Oct 7	21	0.06			9	0.04	0.2	0.03
13	44	0.04	2.4	0.06	14	0.23	1.1	0.02
19	51	0.02	1.7	0.06	249	6.00	39.0	0.04
25	95	0.04	3.1	0.05	105	3.00	16.0	0.03
31	25	0.01	0.9	0.04	104	5.70	20.0	0.01
Nov 6	11	0.01	<0.1	0.02	11	0.31	2.3	0.03
12	12	0.01	<0.1	0.03				
18	12	<0.01	<0.1	0.02	21	0.22	2.2	0.04
24	11	<0.01	0.6	0.01	37	1.50	5.7	0.02
30	10	0.02	<0.1	0.02	18	0.14	2.6	0.04
Dec 6	10	0.11	0.2	<0.01	9	0.10	0.5	<0.01
12					13	0.09	0.2	<0.01
18	30	0.16	0.4	0.04	22	0.31	1.0	0.95
24	48	<0.01	1.0	<0.01	34	0.02	1.1	<0.01
30	12	<0.01	<0.1	<0.01	12	0.11	0.4	<0.01
<u>1990</u>								
Jan 5	12	<0.01	0.1	0.01	27	0.15	0.60	0.09
11	4	0.10	<0.1	<0.01	4	0.03	0.10	0.01
17	12	0.11	0.3	0.01	11	0.19	0.30	<0.01
23	8	<0.01	0.1	<0.01	8	0.05	0.40	<0.01
29	5	0.10	1.0	0.02	33	0.08	<0.10	<0.01
Feb 4	18	0.02	<0.1	<0.01	15	<0.01	0.2	<0.01
10	81	0.06	0.1	0.04	26	0.35	0.5	0.02
16	8	<0.01	<0.1	<0.01	6	0.01	<0.1	<0.01
22	5	<0.01	<0.1	<0.01	9	0.03	<0.1	0.02
28	24	0.01	0.4	<0.01				
Mar 6	5	<0.01	0.1	<0.01	69	0.06	1.3	<0.01
12	7	<0.01	<0.1	0.01	8	<0.01	0.2	<0.01
18	37	<u>2.22<sup>e</sup></u>	1.5	<0.01	17	0.15	0.9	<0.01
24	30	0.02	0.9	<0.01	52	0.29	3.5	0.03
30	29	<0.01	0.5	<0.01	107	0.21	2.0	0.02
Apr 5	58	0.08	2.9	0.01	29	0.01	1.7	0.01
11	35	0.02	1.2	<0.01	38	0.18	2.2	0.56
17	42	0.03	2.1	<0.01				
23					40	0.32	1.9	<0.01
29	8	<0.01	0.3	<0.01	16	0.04	0.8	0.01



TABLE 1. (continued)

Date		Station 61016				Station 61017			
		TSP <sup>a</sup>	As <sup>b</sup>	Fe <sup>c</sup>	Pb <sup>d</sup>	TSP	As	Fe	Pb
<u>1990</u>									
May	5	28	0.02	1.6	<0.01				
	11	47	0.03	2.5	0.01				
	17	16	0.14	0.8	<0.01	18	1.02	1.8	0.01
	23								
	29								
June	4	43	<0.01	0.2	<0.01	116	1.10	10.9	<0.01
	10	61	<0.01	0.5	<0.01	46	0.32	4.5	<0.01
	16	39	0.02	1.9	0.01	155	5.92	30.5	0.02
	22	24	0.03	0.8	<0.01	15	0.08	0.2	<0.01
	28	43	0.03	1.2	<0.01	427	1.05	14.6	0.02
July	4	19	0.01	0.3	0.09	8	0.03	<0.1	<0.01
	10	44	0.05	1.9	<0.01	117	0.46	9.0	<0.01
	16	29	0.03	1.0	<0.01	309	14.23	42.1	0.28
	22	22	0.04	0.3	<0.01	77	0.35	1.4	<0.01
	28	21	0.04	0.2	<0.01	63	0.80	5.5	<0.01
Aug	3					37	0.44	2.4	0.01
	9	37	0.43	1.3	<0.01	58	0.35	1.9	<0.01
	15	21	0.02	0.4	<0.01	18	0.28	1.3	0.08
	21	85	0.04	2.6	<0.01	137	2.15	14.3	0.06
	27	19	0.03	0.7	<0.01				
Sep	2	10	<0.01	0.3	<0.01	24	0.16	1.2	<0.01
	8	21	0.09	0.5	<0.01	44	0.17	1.6	<0.01
	14	18	0.06	0.6	0.01				
	20	11	<0.01	0.3	<0.01	11	0.03	0.2	<0.01
	26	54	0.16	2.3	<0.01	64	0.02	2.3	1.18
Maximum		95	<u>2.20</u>	3.1	0.09	427	14.23	42.1	1.18
Geom. mean		21	0.02	0.5	<0.01	31	0.20	1.3	0.01
Minimum		4	<0.01	<0.1	<0.01	4	<0.01	<0.1	<0.01

<sup>a</sup>TSP = total suspended particulate matter

<sup>b</sup>As = arsenic

<sup>c</sup>Fe = iron

<sup>d</sup>Pb = lead

<sup>e</sup>Value exceeds objective of 0.3 µg/m<sup>3</sup>

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